PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :		(11) International Publication Number:	WO 97/20590
A61M 15/00, B05B 11/00	A1	(43) International Publication Date:	12 June 1997 (12.06.97)

(21) International Application Number: PCT/EP96/05607

(22) International Filing Date: 5 December 1996 (05.12.96)

(30) Priority Data:
195 45 226.7 5 December 1995 (05.12.95) DE

(71) Applicant *(for all designated States except US)*: BOEHRINGER INGELHEIM INTERNATIONAL GMBH [DE/DE]; D-55216 Ingelheim (DE).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: EICHER, Joachim [DE/DE]; Gustav-Korthen-Allee 24, D-44227 Dortmund (DE). SCHYRA, Michael [DE/DE]; Kirchplatz 7, D-42489 Wülfrath (DE). FORSTER, Richard [DE/DE]; Buchtalweg 21, D-92269 Fensterbach (DE).

(74) Agent: THOMAS, Roger, Tamlyn; D. Young & Co., 21 New Fetter Lane, London EC4A 1DA (GB).

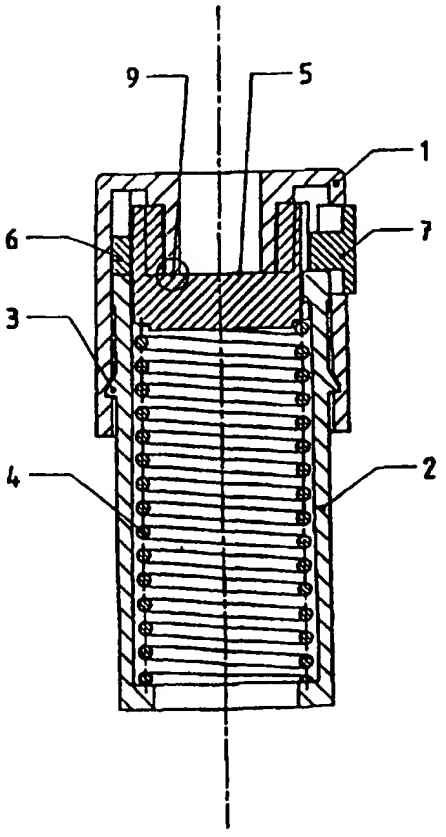
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: LOCKING MECHANISM FOR A SPRING-ACTUATED DEVICE

(57) Abstract

A spring-actuated output drive device is used for example in medical aerosol therapy for a miniaturised high-pressure producing device for atomising a small dose of a liquid medicament. A locking stressing mechanism for such an output drive device is to be stressed with the application of a relatively small amount of force and is to be released with one hand and is to operate reliably over a prolonged period of time. The locking stressing mechanism comprises a force step-up transmission means, for example a screw thrust transmission means, for stressing the spring, an annularly arranged locking member with engaging locking surfaces, two abutments for limiting the travel of the spring and a release button. It is compact, economical to produce, easy to assemble and comprises components with a low rate of wear. It can be reliably and easily handled by unskilled persons, even when high spring forces are involved. A medicament to be atomised can thus be metered with a very high degree of accuracy.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia	**GB**	United Kingdom	**MW**	Malawi
AT	Austria	**GE**	Georgia	**MX**	Mexico
AU	Australia	**GN**	Guinea	**NE**	Niger
BB	Barbados	**GR**	Greece	**NL**	Netherlands
BE	Belgium	**HU**	Hungary	**NO**	Norway
BF	Burkina Faso	**IE**	Ireland	**NZ**	New Zealand
BG	Bulgaria	**IT**	Italy	**PL**	Poland
BJ	Benin	**JP**	Japan	**PT**	Portugal
BR	Brazil	**KE**	Kenya	**RO**	Romania
BY	Belarus	**KG**	Kyrgystan	**RU**	Russian Federation
CA	Canada	**KP**	Democratic People's Republic of Korea	**SD**	Sudan
CF	Central African Republic			**SE**	Sweden
CG	Congo	**KR**	Republic of Korea	**SG**	Singapore
CH	Switzerland	**KZ**	Kazakhstan	**SI**	Slovenia
CI	Côte d'Ivoire	**LI**	Liechtenstein	**SK**	Slovakia
CM	Cameroon	**LK**	Sri Lanka	**SN**	Senegal
CN	China	**LR**	Liberia	**SZ**	Swaziland
CS	Czechoslovakia	**LT**	Lithuania	**TD**	Chad
CZ	Czech Republic	**LU**	Luxembourg	**TG**	Togo
DE	Germany	**LV**	Latvia	**TJ**	Tajikistan
DK	Denmark	**MC**	Monaco	**TT**	Trinidad and Tobago
EE	Estonia	**MD**	Republic of Moldova	**UA**	Ukraine
ES	Spain	**MG**	Madagascar	**UG**	Uganda
FI	Finland	**ML**	Mali	**US**	United States of America
FR	France	**MN**	Mongolia	**UZ**	Uzbekistan
GA	Gabon	**MR**	Mauritania	**VN**	Viet Nam

LOCKING MECHANISM FOR A SPRING-ACTUATED DEVICE

The invention concerns a locking (latchable) stressing (loading) mechanism for a spring-actuated output drive device and is particularly, though not exclusively, concerned with such a device by which a high pressure is produced in a fluid for example by means of a piston in a cylinder.

One aim of the invention is to adapt such a locking stressing mechanism to the requirements of a miniaturised high-pressure producing device.

The invention has been particularly, though not exclusively, developed for application to metered dose inhalers (MDI's) such as are disclosed in US Patent 5497944 (derived from WO91/14468), the entire contents of both of which are incorporated herein by reference. Pressure (generally at least 50 bar) is generated in a metered amount of fluid which is discharged through a nozzle assembly having one or more very small openings e.g. in the range 25 to 500 square micrometres. Preferred nozzle assemblies are disclosed in US Patent 5472143 (and parallel WO94/07607), the entire contents of both of which are incorporated herein by reference. An energy storage means, such as a spring, is preferably manually loaded e.g. by a rotary sawtooth wedge arrangement as disclosed in US Patent 4260082 and GB Patent Application 2291135, the contents of both of which are incorporated herein by reference. A latching mechanism is generally provided to hold the spring in the loaded position and is manually releasable to pressurise the metered amount of fluid e.g. using a piston and cylinder arrangement. A reservoir and valve arrangement can be provided for recharging the cylinder. Further details are described in PCT/EP96/04351 and parallel USSN 08/726219, the entire contents of which are incorported herein by reference.

In the known locking stressing mechanisms (W. Krause: Konstruktionselemente der Feinmechanik, Verlag Carl Hanser, Munich 1993, pages 521 to 523) previously stored energy is

liberated at the required moment and converted into movement. The means for storing the mechanical energy is generally a spring which is coupled to a guided or supported component, referred to as the quick-motion portion. A locking member prevents the quick-motion portion from moving and liberates it in a predetermined manner.

In medical aerosol therapy, aerosols produced by atomisation or spraying of liquid medicaments are used for treating ailments of the respiratory tracts in humans or for the treatment of asthmatic conditions. For that purpose, a high pressure in respect of the fluid is required in order to produce the small droplet size necessary for the aerosol. The high pressure is generally produced by a piston movable in a cylinder (DE-OS 195 36 902.5). For a miniaturised hand-operated cylindrical atomiser of that kind, it is desirable or necessary to produce a relatively high mechanical force to drive the piston within the atomiser itself.

Accordingly another aim of the invention is to develop a locking stressing mechanism which, even in relation to high spring forces, is simple and reliable to operate.

In accordance with one aspect of the invention, there is provided a locking stressing mechanism for a spring-actuated output drive device, which mechanism includes a spring as a storage means for the mechanical energy which acts on an output drive member as a quick-motion portion, the movement of which is determined by the position of a locking member, a drive for stressing the spring, an upper and a lower abutment for the output drive member and a means for releasing the locking member, the device having a force step-up transmission means between the drive for stressing the spring and the spring, and an annularly arranged locking member with engaging locking surfaces.

The energy storage means is preferably a coil spring or a plate or diaphragm spring which acts as a tension spring or as a compression spring and which is preferably cylindrical.

The spring can be stressed by means of a direct drive. For that purpose the output drive flange is displaced by an axially operative external force. In the case of a high spring force, it is advantageous to provide a force step-up transmission means, for example a screw thrust transmission means, by means of which the spring is stressed by an external torque which may be manually applied. In the case of a screw thrust transmission means, an upper housing portion and the output drive member include a single-flight or multi-flight wedge drive. Such a transmission means is arranged between the drive for stressing the spring and the spring.

The locking member can be a ring which is radially elastically deformable in itself or a rigid ring with cam projections or a rigid ring with leaf springs formed thereon or a rigid ring which can be subjected to a spring prestressing effect by one or more metal springs. The ring can be closed or open and may comprise a plurality of and preferably two parts. The locking member comprises plastics material or metal. It is arranged displaceably in a plane perpendicularly to the cylinder axis or it is deformable in said plane.

After stressing of the spring the locking surfaces of the locking member move into the path of the spring or the output drive member and prevent release of the spring.

The locking member is preferably actuated by means of a release button. The button may be coupled or connected to the locking member. To release the locking stressing mechanism a release button of this kind and therewith the locking member are generally displaced parallel to the plane of the ring, more particularly and preferably towards the cylinder axis, or the locking member is radially deformed in the plane of the ring.

The travel of the output drive member is precisely delimited by defined abutments. Preferably the drive member is a flange on a further output member.

According to another aspect of the invention, there is provided a spring-loaded drive mechanism in which an output

member is mounted for linear movement against the bias of a spring between a released position and a locked position and in which there is a locking member which can be moved transversely to the direction of movement of the output member into and out of the path of an abutment means associated with the output member, wherein the locking member is substantially in the form of an open or closed ring such that the abutment means can pass through it under the action of the spring when the mechanism is released and wherein the substantially ring-like locking member may optionally be in two or more sections.

Preferably the locking member forms an optionally interrupted closed ring but it could be in the form of an open ring or yoke. It is also desirable that the locking member engages the abutment means in such a way as to minimise the risk of tilting and binding of the output member. This may for example be achieved by arranging for engagement at least at two positions which are substantially diametrically opposite each other.

Other preferred features include the following:

- The spring is a helical compression spring.
- The locking member snaps into alignment with the abutment means when the output member reaches the locked position.
- The snap action is provided by cams associated with means for moving the output member from the released position to the locked position.
- The snap action is provided by one or more springs.
- The locking member is resiliently deformable so as to provide the snap action.
- The locking member is arranged to be manually moved out of the path of the abutment means.
- There is a force step-up transmission for moving the output means against the bias of the spring.
- The transmission comprises a rotatable part with a sawtooth thrust cam.
- The output member is arranged to move a piston in a cylinder to compress fluid therein.

- The mechanism is part of a device for spraying fluid or, more specifically, part of a metered dose inhaler.

Preferred embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1a is a view in vertical longitudinal section through a locking stressing mechanism according to the invention with the locking member disengaged and the spring in its released position;

Figure 1b is a similar view of the same mechanism with the locking member engaged and the spring in its compressed position;

Figures 2a and 2b are horizontal section views corresponding to Figures 1a and 1b and showing the locking member in its disengaged and engaged positions respectively;

Figures 3a and 3b are views similar to Figures 2a and 2b showing a second embodiment of the locking member;

Figures 4a and 4b are views similar to Figures 2a and 2b showing a third embodiment of the locking member;

Figures 5a and 5b are views similar to Figures 2a and 2b showing a fourth embodiment of the locking member;

Figures 6a and 6b are views similar to Figures 2a and 2b showing a fifth embodiment of the locking member.

Figure 1a is a view in longitudinal section through a locking stressing mechanism. The upper cylindrical housing portion 1 engages over the spring housing 2 to which it is connected by way of snap-engagement projections 3. The snap-engagement projections 3 are disposed on the outside of the spring housing 2 and extend over two mutually oppositely disposed circular segments each of about 30°. They engage into a peripherally extending groove on the inside of the upper housing portion. The two housing portions are therefore rotatable relative to each other. Disposed in the spring housing 2 is the compression spring 4 which is generally already prestressed when the two housing portions are fitted together. The compression spring 4 is supported on a peripherally extending

projection at the lower end of the spring housing and on the output drive member 5 which is arranged displaceably in axis-parallel relationship between the upper housing portion and the spring housing and which in turn presses against the upper housing portion 1. The cylindrical cup-shaped output drive member is mounted slidably in the cylindrical bore of housing 2 but projects into the upper housing portion. The annular locking member 6 extends around the output drive member. The release button 7 which is mounted on the locking member projects laterally out of the upper housing portion. In the preferred arrangement the member 5 is a flange on a hollow piston (not shown) reciprocable in a cylinder (not shown) in the upper housing portion which is connected to an atomising means. The lower end of the piston is connected to a reservoir (not shown), the whole mechanism being part of an MDI.

In the case of a screw-type thrust transmission means the collar of the cup-shaped output drive member generally includes two sawtooth-shaped recesses against which two saw teeth in the upper housing portion slide. The saw teeth and recesses are shown in highly simplified form in Figure 1a. When the upper housing portion is rotated relative to the spring housing the output drive member is urged further into the spring housing against the force of the compression spring. As soon as the upper edge of the output drive member has been urged downwardly sufficiently far through the locking member, the annular locking member is displaced perpendicularly to the axis of the housing between the upper edge of the output drive member and an annular projection in the upper housing portion and holds the output drive member and the compression spring which is (additionally) stressed by the displacement of the output drive member, fast in the position attained.

The average spring force is 10 to 150 N. Between the upper and lower rest position of the output drive member the spring force alters approximately by ± 10% of the average spring force.

Pressing the release button 7 causes the annular

locking member to be pushed back perpendicularly to the axis of the housing whereby the path of movement of the output drive member is cleared. The compression spring pushes the output drive member upwardly over a predetermined distance and in so doing actuates a component (not shown) which is connected to the output drive member, for example a piston in a cylinder.

Figure 1a shows the locking stressing mechanism with the output drive member in its upper rest position and with the locking member disengaged. Figure 1b shows the locking stressing mechanism with the output drive member in its lower rest position and with the locking member engaged. The abutment 8 is the means for delimiting the travel of the output drive member in the lower rest position thereof while the abutment 9 is the means for delimiting the travel in the upper rest position thereof. Rotation of the two housing portions relative to each other causes the mechanism to go from the condition shown in Figure 1a into the condition shown in Figure 1b. Pressing the release button causes the mechanism to go from the condition shown in Figure 1b into the condition shown in Figure 1a.

Figures 2a and 2b show a view in cross-section through the locking stressing mechanism at the level of the middle of the annular locking member, more specifically Figure 2a corresponding to the condition of the locking stressing mechanism as shown in Figure 1a in the disengaged position of the locking member and Figure 2b corresponding to the condition of the locking stressing mechanism as shown in Figure 1b with the locking member in the engaged position.

Figures 3a to 6b show a number of embodiments according to the invention of the annular locking member, more specifically partly in cross-section approximately at the level of the middle of the annular locking member and partly as a plan view with the bottom of the upper housing portion in section. Figures 3a, 4a, 5a and 6a show the locking member in the disengaged position while Figures 3b, 4b, 5b and 6b show the locking member in the engaged position.

In Figures 3a and 3b, a bevelled cam projection 11 is disposed on the outer peripheral surface of the locking member 10. A further bevelled cam projection 12 is disposed on the upper edge of the spring housing 2. Towards the end of the rotary movement of the upper housing portion relative to the spring housing the two cam projections come to bear against each other with their bevelled sides and the cam projection on the spring housing pushes the locking member 10 into the engaged position. When the release button is actuated the locking member is pushed back into the disengaged position and the path of movement of the output drive member is cleared.

In Figure 4a the locking member 13 is provided with two integrated springs 14 which urge the locking member in the upper rest position of the locking stressing mechanism against the outer peripheral surface of the output drive member 5. As soon as the upper edge of the output drive member 5 has been pressed through the locking member the locking member is displaced by the force of the integrated springs into the engaged position shown in Figure 4b. When the release button is actuated the locking member is pushed back into the disengaged position against the force of the integrated springs and the path of movement of the output drive member is cleared.

Figure 5a shows a locking member 15 whose prestressed arcuate portions 16 initially press against the outer peripheral surface of the output drive member 5. As soon as the upper edge of the output drive member has been pressed through the locking member the prestressed arcuate portions 16 jump over the upper edge of the output drive member into the engaged position. When the release button is actuated the arcuate portions 1 by virtue of their bending loading, are urged outwardly and clear the way for displacement of the output drive member.

Figure 6a shows a two-part locking member 17 with integrated springs. Each spring portion 18 is rotatably mounted on an axis 19. A projection 20 is disposed on the inside of each spring portion. As soon as the upper edge

of the output drive member has been pressed through the locking member the projections 20 jump over the upper edge of the output drive member into the engaged position. When the release button is actuated the spring portions 18 are urged outwardly with the projections 20 and clear the way for displacement of the output drive member.

A locking stressing mechanism as just described with reference to the drawings has the following advantages:

- It is simple and reliable to operate even by unskilled persons.
- It can be triggered with one hand by pressing the release button.
- When using a force step-up transmission means, for example a screw thrust transmission means, it is possible to produce a high spring force by means of a low level of torque.
- The movement of the locking member can be positively coupled to the rotary movement for stressing the spring in a simple manner.
- It can be produced economically and is easy to assemble.
- It comprises functional elements which have a low rate of wear and it is reliable in operation.
- It is compact and can easily be adapted to a miniaturised high-pressure atomiser. The metering effect is very accurate because of the defined abutments for the output drive member.

CLAIMS

1. A spring-loaded drive mechanism in which an output member is mounted for linear movement against the bias of a spring between a released position and a locked position and in which there is a locking member which can be moved transversely to the direction of movement of the output member into and out of the path of an abutment means associated with the output member, wherein the locking member is substantially in the form of an open or closed ring such that the abutment means can pass through it under the action of the spring when the mechanism is released and wherein the substantially ring-like locking member may optionally be in two or more sections.

2. A mechanism according to Claim 1 wherein the locking member forms an optionally interrupted substantially closed ring.

3. A mechanism according to Claim 1 or 2 wherein the locking member engages the abutment means at least at two positions which are substantially diametrically opposite each other.

4. A mechanism according to Claim 1, 2 or 3, wherein the spring is a helical compression spring.

5. A mechanism according to any preceding claim, wherein the locking member snaps into alignment with the abutment means when the output member reaches the locked position.

6. A mechanism according to Claim 5 wherein the snap action is provided by cams associated with means for moving the output member from the released position to the locked position.

7. A mechanism according to Claim 5 wherein the snap action is provided by one or more springs.

8. A mechanism according to Claim 5, wherein the locking member is resiliently deformable so as to provide the snap action.

9. A mechanism according to any preceding claim wherein the locking member is arranged to be manually moved out of the path of the abutment means by pressure on an actuating means.

10. A mechanism according to any preceding claim comprising a force step-up transmission for moving the output means against the bias of the spring.

11. A mechanism according to Claim 10 wherein the transmission comprises a rotatable part with a sawtooth thrust cam.

12. A mechanism according to any preceding claim wherein the output member is arranged to move a piston in a cylinder to compress fluid therein.

13. A device for spraying fluid comprising a mechanism according to Claim 12.

14. A device according to Claim 13 which is a metered dose inhaler.

15. A locking stressing mechanism for a spring-actuated output drive device comprising a spring which acts on an output drive member which acts as a quick-motion member, a drive for stressing the spring, a locking member, an upper and a lower abutment for the output drive member, and a means for releasing the locking member, characterised by

- a force step-up transmission means between the drive for stressing the spring and the spring, and
- an annularly arranged locking member with engaging locking surfaces.

16. A locking stressing mechanism according to claim 15 comprising

- a coil spring or
- a plate spring which
- acts as a tension spring or as a compression spring and is preferably cylindrical.

17. A locking stressing mechanism according to claims 15 or 16 comprising
- a screw thrust transmission means as the force step-up transmission means between the drive for stressing the spring and the spring.

18. A locking stressing mechanism according to any one of claims 15 to 17 comprising
- an open or closed ring as the locking member which is arranged displaceably in a plane perpendicularly to the axis of the cylindrical locking stressing mechanism.

19. A locking stressing mechanism according to any one of claims 15 to 18 comprising
- a locking member in the form of a radially elastically deformable ring or
- in the form of a rigid ring with leaf springs formed thereon or
- in the form of a rigid ring with cam projection or
- in the form of a rigid ring and a metal spring.

20. A locking stressing mechanism according to any one of claims 15 to 19 comprising
- a locking member of plastics or metal.

21. A locking stressing mechanism according to any one of claims 15 to 20 comprising
- a release button connected or coupled to the locking member.

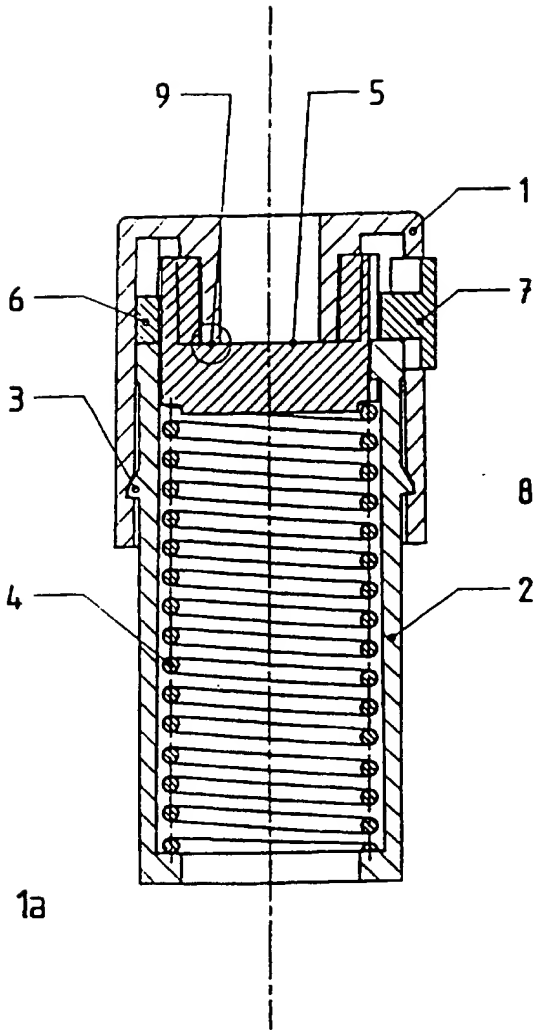


Fig. 1a

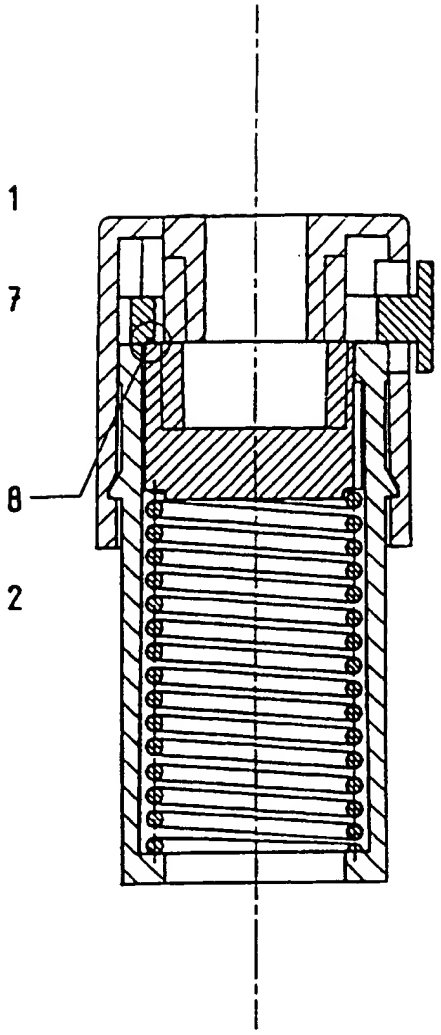


Fig. 1b

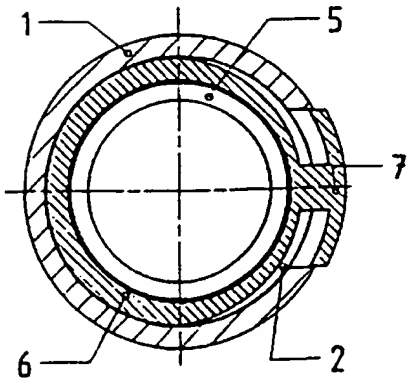


Fig. 2a

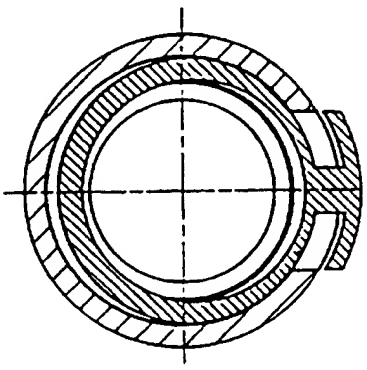


Fig. 2b

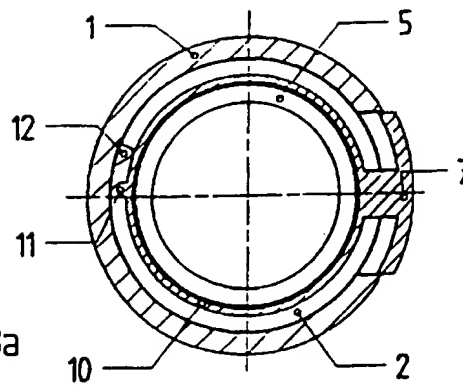


Fig. 3a

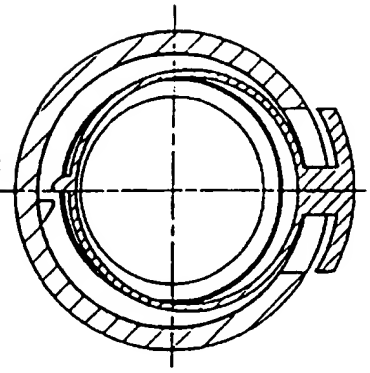


Fig. 3b

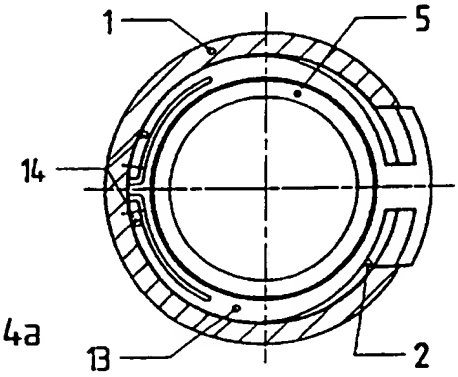


Fig. 4a

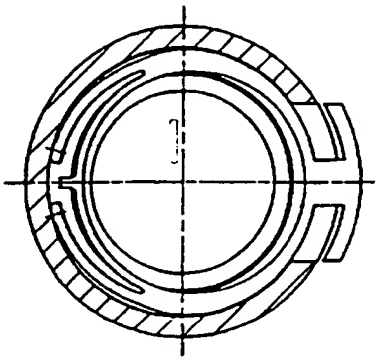


Fig. 4b

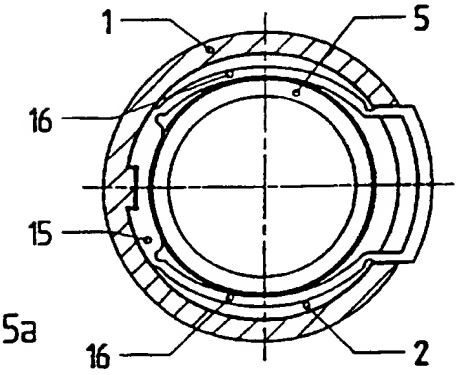


Fig. 5a

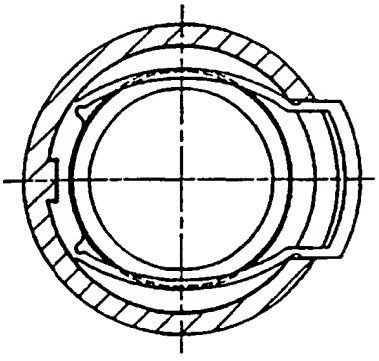


Fig. 5b

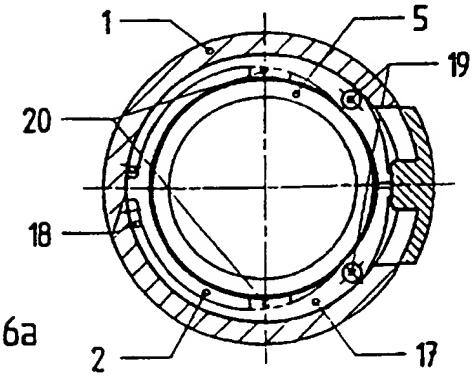


Fig. 6a

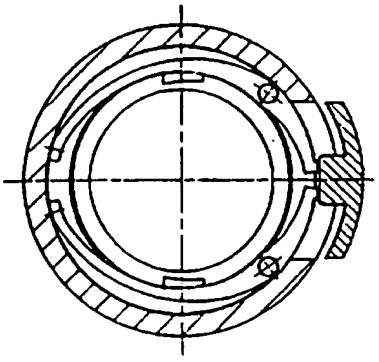


Fig. 6b

INTERNATIONAL SEARCH REPORT

Intern. al Application No
PCT/EP 96/05607

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A61M15/00 B05B11/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A61M B05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	WO 92 20455 A (GALLI ROSARIA & C) 26 November 1992 see claims 1-3; figures 1-7 ---	1-6, 12-14 10,11
Y	US 5 310 092 A (TARGELL) 10 May 1994 see abstract; figures ---	10,11
X Y	US 4 787 891 A (LEVIN PAUL D ET AL) 29 November 1988 see column 2, line 30 - line 59; figures 4,5,7 ---	1,2,4,5, 9 15-21
Y	US 4 260 082 A (ROONEY ET AL) cited in the application see abstract; figures 1,2,8 --- -/--	15-21

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

1

Date of the actual completion of the international search	Date of mailing of the international search report
2 April 1997	22.04.97

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+ 31-70) 340-3016	Villeneuve, J-M

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Inten nal Application No
PCT/EP 96/05607

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 612 051 A (ARCE RAUL OLVERA) 12 October 1971 see abstract; figures 3-6	1-5,8,9
X	US 5 263 475 A (ALTERMATT DANIEL ET AL) 23 November 1993 see column 12, line 26 - line 65; figures 9-13 see column 13, line 66 - column 14, line 18; figure 15	1,2,4,5, 7,9-11, 15,16, 18-21
A	US 5 388 572 A (MULHAUSER ET AL.) 14 February 1995 see column 8, line 44 - line 64; figures 12A-12C	10,11

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

...formation on patent family members

Inter ...al Application No
PCT/EP 96/05607

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9220455 A	26-11-92	IT 1249094 B	11-02-95
		IT 1253171 B	10-07-95
US 5310092 A	10-05-94	GB 2243880 A	13-11-91
		AT 120386 T	15-04-95
		AU 7770691 A	27-11-91
		DE 69108550 D	04-05-95
		DE 69108550 T	03-08-95
		EP 0527162 A	17-02-93
		WO 9116993 A	14-11-91
US 4787891 A	29-11-88	NONE	
US 4260082 A	07-04-81	NONE	
US 3612051 A	12-10-71	NONE	
US 5263475 A	23-11-93	AU 650953 B	07-07-94
		AU 1219292 A	24-09-92
		BG 60308 B	27-05-94
		CA 2076938 A	01-03-93
		CZ 280500 B	14-02-96
		EP 0505321 A	23-09-92
		HU 67163 A	28-02-95
		IL 101289 A	14-05-96
		JP 5103835 A	27-04-93
		PL 169776 B	30-08-96
		SI 9210252 A	28-02-95
US 5388572 A	14-02-95	AU 7393994 A	22-05-95
		BR 9407893 A	19-11-96
		CA 2157583 A	04-05-95
		CN 1120812 A	17-04-96
		EP 0732951 A	25-09-96
		FI 954099 A	01-09-95
		NO 953427 A	09-10-95
		WO 9511715 A	04-05-95